

UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

4500-FS-NE-2202.93

STUDY PLAN

DETERMINATION OF THE EFFICACY OF

THE NEODIPRION LECONTEI FITCH

NUCLEOPOLYHEDROSIS VIRUS PRODUCT "LECONTVIRUS"



by

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STUDY ABSTRACT

Study Number: 4500-FS-NE-2202.93 ☒ Cooperative Study

Study Title: Determination of the efficacy of the Neodiprion lecontei Fitch nucleopolyhedrosis virus product "Lecontvirus".

Study Location: Hamden, CT; Madison, WI; St. Paul, MN; Antigo, WI; Manistee National Forest, MI.

Schedule: Proposed: 4/82 Estimated completion: 1/83
Established: 6/82

Assignment: Requirements are one project scientist 1/4 time for the duration and one biological laboratory technician for 2 weeks in July 1982.

Cooperation: USDA-FS-NA, S&PF, FPM, St. Paul, MN,
Wisconsin Department of Natural Resources,
USDA-FS-NFS-Region 9, Cadillac, MI.
Canadian Forestry Service

ABSTRACT

Problem: Information is lacking on efficacy of the Canadian N. lecontei NPV product, "Lecontvirus" on sawfly populations within the United States. As a requirement for a registration of use of this product in the United States, efficacy data must be obtained.

Objectives:

- 1.) To determine percent reduction of sawfly populations following application of "Lecontvirus".
- 2.) To determine the degree of foliage protection afforded as a direct result of "Lecontvirus" application.

Methods:

- 1.) Establish plots within moderate to high density N. lecontei populations in red-pine plantations in northern Wisconsin and Michigan.
- 2.) Select, tag and count (larvae/colony) sawfly colonies for population reduction and foliage protection evaluation.
- 3.) Treat plots with "Lecontvirus" formulation; 3 doses replicated thrice.
- 4.) Make weekly counts of healthy, infected and dead larvae post application; make defoliation estimates.
- 5.) Evaluate data (MANOVA, ANOVA).
- 6.) Prepare final reports.

PROBLEM REFERENCE

Refer to: RWUD-FS-NE-2202

Problem 1: Need to improve microbial control technology by developing and testing various insect pathogens.

INTRODUCTION

The red-headed pine sawfly, Neodiprion lecontei Fitch, is a serious pest in young pine plantations in eastern Canada and in the northern United States where its principal hosts are red pine, Pinus resinosa Ait., Scots pine, P. sylvestris L., and jack pine P. banksiana Lamb. Generally, trees less than 15-feet high are preferred and can be killed following one complete defoliation (Wilson and Reeks, 1967). Thus, Christmas tree plantations and watershed plantings are particularly susceptible and can suffer significant losses if heavily infested.

N. lecontei is susceptible to a naturally occurring nucleopolyhedrosis virus (NPV) (Baculovirus) disease first diagnosed by Steinhaus (1951). Use of this virus in Canada has been so promising (Bird, 1961) as to persuade the Canadian government to promote the use of the agent and to gather data to register it officially in Canada (Cunningham and Entwistle, 1981). Through a cooperative effort with the Canadian Forestry Service, the U.S. Forest Service will utilize Canadian data in support of registration of this virus for use in the United States. Data on efficacy of the Canadian NPV product, "Lecontvirus,"

toward N. lecontei populations in the United States are lacking but necessary to support the registration and labeling of this product in the U.S. The purpose of this study is to gather this data.

OBJECTIVES

The objective of this study is to evaluate efficacy of the NPV product "Lecontvirus" on N. lecontei populations in the United States. More specifically, to determine:

1. The percent reduction in sawfly populations following application of the product.
2. The degree of foliage protection afforded as a function of "Lecontvirus" application and subsequent population reduction.

METHODS

Study areas and design

The study will be conducted during June-September 1982 in young pine plantations in northern Wisconsin and Michigan. Four blocks will be established within each state. Blocks will be selected on the basis of similar tree size (4-8 ft) and condition, and N. lecontei egg density. Four 0.4-ha plots, separated by at least 100 m will be established within each block and randomly assigned one of 4 treatments: (1) 1×10^9 polyhedral inclusion bodies (PIB) of N. lecontei NPV ("Lecontvirus")/ha, (2) 5×10^9 PIB/ha, (3) 1×10^{10} PIB/ha and (4) no treatment (control).

NPV source

"Lecontvirus" will be supplied by Dr. John Cunningham, Canadian Forestry Service, as a dry, lyophilized powder containing $\geq 1 \times 10^{10}$ PIB/g (0.05% PIB = active ingredient).

Formulation and application

The formulation will contain "Lecontvirus", Rhoplex[®] (sticker), red food coloring and water in the following quantities per gallon of finished tank mix.

Ingredient	Low Dose	Medium dose	High dose
"Lecontvirus"	0.8×10^8 PIB	4.0×10^8 PIB	8.0×10^8 PIB
Rhoplex	2.6 oz (77 ml)	2.6 oz	2.6 oz
Red food coloring	0.6 oz (18 ml)	0.6 oz	0.6 oz
Water	124.8 oz (3.7 l)	124.8 oz	124.8 oz

The appropriate amount of "Lecontvirus" for a 0.4 ha treatment will be titrated in a tissue homogenizer with 5 ml of non-chlorinated water and then added to a 5 gal. container (approximate) in which the appropriate amount of sticker, red food coloring and non-chlorinated water for a 0.4 ha treatment have been pre-mixed. The formulation will be further mixed by vigorous agitation and then added to the tank of a back-pack mist blower where it will again be mixed prior to application.

The virus will be introduced as a single application in either the early morning or early evening. The material will be applied by back-pack mist blower at the rate of 47.5 liters/ha (5 gal/A). "Lecontvirus" will be applied when N. lecontei egg hatch is complete and when larvae are in the first and second stages. Spray deposit will be assessed using deposit cards place adjacent to tagged colonies in the treatment and control plots.

Spraying will not begin or be continued if (1) wind velocity is ≥ 8 mph (2) air turbulence is so great as to affect spray pattern or cause excessive drift (3) rain is predicted within 24 hr, and within 24 hrs after rain has ended, unless strong drying winds have occurred.

Sampling and Evaluation

Before spray application, 3 isolated N. lecontei larval colonies, similar in size and rate of development, will be selected and tagged on each of 10 trees in each plot within each block. A grid system will be established within each 0.4 ha plot and the 10 trees will be systematically selected so as to represent the sawfly population in the entire plot. Larval densities will be determined by counting all larva in each selected colony prior to treatment and at weekly intervals thereafter. The number of healthy, infected and dead larvae will be recorded on each occasion. Larval counts will continue until all surviving larvae have pupated.

Defoliation will be measured as cm of branch defoliated per 100 larvae. One colony bearing branch on each of 10 trees per plot will be selected for measurement.

Multivariate analysis of variance (MANOVA) will be used to compare population changes over time between plots, while a univariate procedure (ANOVA) will be used to evaluate defoliation.

APPLICATION OF RESEARCH RESULTS

Data gathered during this study will be presented as a written report to the U.S. Environmental Protection Agency (EPA) to support a registration of use of "Lecontvirus" in the U.S. Results will also be presented, either by journal or station publication or by talks before interested user groups.

SAFETY AND HEALTH

Although there is no evidence to indicate that N. lecontei NPV is hazardous to man, precautions will be taken to minimize its contact with either those working directly on the study plots or those who might accidentally wander into the study area. Local, state and Federal regulations with regard to transport, storage, experimental use and disposal of the virus will be followed. Study plots will be located away from human habitation and in an area not frequented by campers, hikers, etc. Plots will be clearly posted as to their use as experimental areas. Workers on the study plots will be trained in the safe and proper use of vehicles and specialized pesticide application equipment. NPV will be applied in the early morning and/or evening to minimize drift into surrounding areas. Those involved with the application of the virus will wear protective clothing, respirators and goggles.

ENVIRONMENTAL CONSIDERATIONS

It is expected that this study will have no significant environmental impact and is the type of action that can be categorically excluded since it is a research activity that has limited context and will minimally offset the physical, biological, economic or social components of the environment (FSM 1952.1.5). The study will be covered under an experimental use permit granted by EPA.

PERSONNEL, DURATION AND COST

Interagency Cooperation

The cooperating units are:

1. Forest Insect & Disease Research, RWU 2202, NE, Hamden, CT
2. Forest Pest Management, NA, S&PF, St. Paul, MN
3. Forest Pest Management, Wisconsin, DNR, Madison, WI

Responsibilities:

1. Forest Insect & Disease Research has primary responsibility for study plan preparation, will provide on-site technical assistance at spray time, will provide mist blower, will assist in ground application of "Lecontvirus," will provide the formulation ingredients for the study, and will participate in the evaluation of the study.
2. Forest Pest Management, S&PF, will assist in writing the study plan, will assist in the establishment, sampling, and treatment of plots in Wisconsin and Michigan, and will participate in the evaluation of the study.
3. Forest Pest Management, Wisconsin DNR, will assist in study plan preparation, will assist in the establishment and sampling and treatment of plots in Wisconsin, and will participate in the evaluation of the study.

All units will assist in data evaluation and will share authorship on any resulting manuscripts.

Duration

Plots will be established in June 1982, treated July and evaluated July - September. A final report will be prepared by 1 January 1983.

Personnel (RWU 2202)

The study will require one Microbiologist 1/4 time for 6 months (1982) and one Biological Lab technician for 2 weeks in July 1982.

Costs (RWU 2202)

	<u>Estimated Cost</u>
<u>Wages</u>	
OT (2 days)	240
<u>Per diem</u>	
10 days at \$50.00	500
<u>Travel</u>	
Rental car	400
Air fares	1000
<u>ADP</u>	100
<u>Supplies and Equipment</u>	200
Total	2,440

LITERATURE CITED

1. Bird, F.T. 1961. Transmission of some insect viruses with particular reference to ovarian transmission and its importance in the development of epizootics. J. Insect. Pathol 3: 352-380.
2. Cunningham, J.C., and P.F. Entwistle. 1981 Control of sawflies by Baculovirus. pp. 379-407. In: H.D. Burges (ed), Microbial control of pests and plant diseases, Academic Press, N.Y.
3. Steinhaus, E.A. 1951. Report on diagnosis of diseased insects 1944-1950. Hilgardia 20:629-678.
4. Wilson, L.F. and W.A. Reeks. 1967. Red-headed pine sawfly Neodiprion lecontei (Fitch). pp. 131-133. In A.F. Davidson and R.M. Prentice (eds.). Important forest insects and diseases of mutual concern to Canada, The United States and Mexico. Roger Duhamel, Ottawa.